Project Introduction

Clear Science Corp. and Duke University propose to develop and demonstrate new and efficient computational methods of modeling nonlinear aeroelastic systems. The methods will extend the scope of multi-disciplinary computational tools like NASA Dryden's STARS by augmenting linear eigenmode stability algorithms and coupled time-marching techniques. The objective is low-dimensional models that accurately reflect nonlinearity in both structure and fluid and that are efficient enough to permit full exploration of parameter space. In Phase I, our team has demonstrated the technical merit and feasibility of two types of model order reduction: proper orthogonal decomposition (POD) of the coupled-system variables and the method of harmonic balancing (HB). The HB and POD methods represent complementary and synergistic tracks toward meeting the objective of modeling fully nonlinear aeroelastic systems, providing the capability of efficiently analyzing important nonlinear aeroelastic behavior like limit cycle oscillations, hysteresis, higher harmonic and sub-harmonic resonances, jump resonances, entrainment, beating, and period doubling. The innovation offers the possibility of engineering software for predicting nonlinear aeroelastic behavior that is as accurate and efficient as the current methods of analyzing linear systems and linear behavior like flutter. In Phase II, we propose to integrate the POD and HB methods into a single package that facilitates engineering trade-studies early in the design process.

Primary U.S. Work Locations and Key Partners
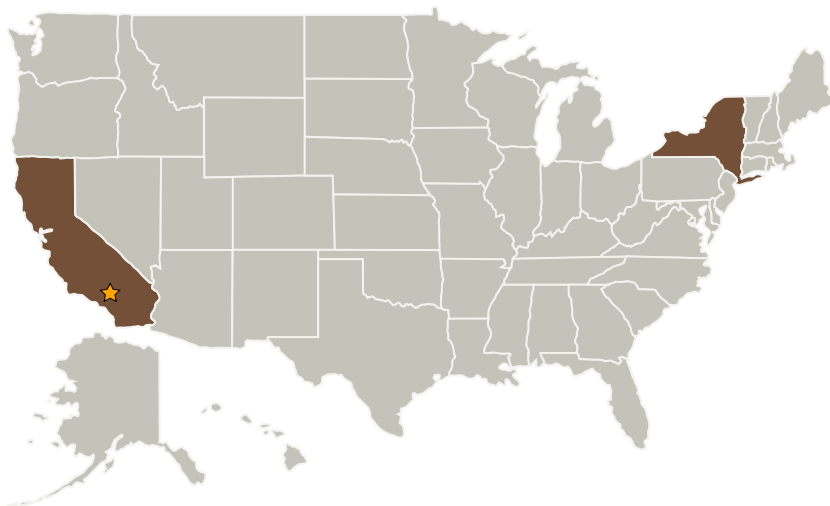
Computational Models for Nonlinear Aeroelastic Systems, Phase II

Table of Contents

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Armstrong Flight Research Center (AFRC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Organizations Performing Work	Role	Type	Location
⭐Armstrong Flight Research Center(AFRC)	Lead Organization	NASA Center	Edwards, California
Clear Science Corporation	Supporting Organization	Industry	Harford, New York

Primary U.S. Work Locations	
California	New York

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX15 Flight Vehicle Systems
  - └ TX15.1 Aerosciences
    - └ TX15.1.3 Aeroelasticity